Where the relation between x and y can be expressed as $y = mx + b$ ($m \neq 0$), the relation is called a **linear function**. The graph of a linear function is a straight line.

m = gradient , b = y-intercept

$y = 3x + 1$

Gradient: 3 $\quad$ y-intercept: 1

$y = -\dfrac{3}{2}x + 5$

Gradient: $-\dfrac{3}{2}$ $\quad$ y-intercept: 5

The gradient of a line that passes through two points (a, b) and (c, d) can be found as follows:

$$\text{Gradient} = \frac{d-b}{c-a}$$

How to determine the equation of a line

Method 1: First determine the gradient of the line, then substitute any point to find the y-intercept

Determine the equation of a line that passes through $(5, 3)$ and $(7, 6)$.

The gradient is $\dfrac{6-3}{7-5} = \dfrac{3}{2}$

Let $y = \dfrac{3}{2}x + b \quad \cdots ①$

Substituting $x = 5$ and $y = 3$ into ①,

$$3 = \frac{15}{2} + b$$

$$b = -\frac{9}{2}$$

Therefore $y = \dfrac{3}{2}x - \dfrac{9}{2}$

Method 2: Substitute the points into the equation of the line and solve simultaneous equations

Determine the equation of a line that passes through $(2, 3)$ and $(4, 7)$.

Let the equation of the line be $y = mx + b \quad \cdots ①$

Since the line passes through $(2, 3)$,

$3 = 2m + b \quad \cdots ②$

Since the line passes through $(4, 7)$,

$7 = 4m + b \quad \cdots ③$

Solving ② and ③, we find

$m = 2$ and $b = -1$

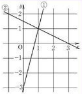
Substituting the values of m and b into ①,

$y = 2x - 1$

The solution of the simultaneous equations corresponds to the point of intersection of the two lines whose equations are given.

① $y = 4x - 3$

② $y = -\dfrac{1}{2}x + \dfrac{3}{2}$



The point of intersection is $(1, 1)$

The equation $x = k$ is a line that passes through $(k, 0)$ and is parallel to the y-axis.

The equation $y = m$ is a line that passes through $(0, m)$ and is parallel to the x-axis.

Theorem: Two lines are parallel if and only if their gradients are equal.

H 181-200 : Simplifying Monomials & Polynomials

1) Determine the sign of the answer.

2) Calculate the numbers in front of the letters.

3) Calculate the powers of each variable.

$$(-2a^2b)(-3a^5b^3) = 6a^7b^4$$

$$5x(-yz^2)^3 = -5x \cdot y^3z^6 = -5xy^3z^6$$

$$4a^3(-2b^2c)^4 = 4a^3 \cdot 16b^8c^4 = 64a^3b^8c^4$$

$$-3a^2b^3\left(-\frac{2}{3}bc^2\right)^3 = 3a^2b^3 \cdot \frac{8}{27}b^3c^6 = \frac{8}{9}a^2b^6c^6$$

Reduce when dividing expressions.

$$12a^2x^5y^4 \div (3ax^2y)^2 = \frac{12a^2x^5y^4}{9a^2x^4y^2} = \frac{4xy^2}{3}$$

$$\frac{2}{3}ab^3 \div \left(-\frac{1}{6}ab\right)^2 = \frac{2}{3}ab^3 \div \left(\frac{1}{36}a^2b^2\right) = \frac{2ab^3}{3} \times \frac{36}{a^2b^2} = \frac{24b}{a}$$

The distributive property

$$3a(a - 4b) = 3a^2 - 12ab$$

$$\begin{aligned} 2x(x+4) - 3x(2x-5) &= 2x^2 + 8x - 6x^2 + 15x \\ &= -4x^2 + 23x \end{aligned}$$

$$\begin{aligned} \frac{1}{2a}(8a^3 - 12a^2 + 6a) &= \frac{8a^3}{2a} - \frac{12a^2}{2a} + \frac{6a}{2a} \\ &= 4a^2 - 6a + 3 \end{aligned}$$

$$\begin{aligned} \frac{-10x^2y + 6x^2y^2 - 2xy}{-2xy} &= \frac{-10x^2y}{-2xy} + \frac{6x^2y^2}{-2xy} + \frac{-2xy}{-2xy} \\ &= 5x - 3xy + 1 \end{aligned}$$